

REMARKS

Claims 1 through 6, 8 through 16, 18 through 21 and 23 through 29 are now pending in this application. Claims 9 through 13 and 24 through 28 stand withdrawn. In response to the non-final Office Action dated March 23, 2006, claims 1, 3, 4, 6, 15, 18 and 21 have been amended and claims 2, 7, 17 and 22 have been cancelled. Care has been taken to avoid the addition of new matter. Favorable reconsideration of the application is respectfully solicited.

Claims 1 through 3, 7, 14 through 18, 22 and 29 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. patent 6,243,517 (Deacon). In response, claims 1, 3, 15 and 18 have been amended and claims 2, 7, 17 and 22 have been cancelled. To the extent that the rejection may be considered with respect to the claims as now amended, the rejection is respectfully traversed.

Independent claim 1 has been amended to specify that the previously recited optical semiconductor element is a semiconductor optical amplifier, and further to require, *inter alia*, the following:

a second bonding material for fixing said optical circuit element in a predetermined position on the element mount surface of said silicon bench, while setting said optical circuit element apart from said silicon bench at a predetermined distance,

wherein each of said N semiconductor optical amplifier is mounted on the element mount surface of said silicon bench such that said light emission layer is positioned between the one surface of said semiconductor substrate and the element mount surface of said silicon bench, and

wherein said optical circuit element is mounted on the element mount surface of said silicon bench such that said optical waveguide is positioned between the one surface of said silica-based substrate and the element mount surface of said silicon bench.

Independent claim 15 has been amended to contain similar subject matter.

As exemplified in Figs. 1-3 (described at pages 13-17 of the specification), the claimed invention comprises a semiconductor optical amplifier (20), an optical circuit element (30) having an optical waveguide, and a silicon bench (10) that is formed independently from these optical components. The semiconductor optical amplifier (20) and optical circuit element (30) are mounted on the silicon bench (10) through the bonding materials. The structural configuration permits changing the mounted element (30) to other optical components with respect to the silicon bench (10). That is, the optical circuit element (30), which is mounted on the silicon bench (10) through the bonding material, is apart from the element mount surface of the silicon bench (10) at a predetermined distance. In addition, the semiconductor optical amplifier (20) and optical circuit element (30) are arranged on the silicon bench (10) such that the surface (opposing the semiconductor substrate) on which an active layer is formed and the surface (opposing the silica-based substrate) on which an optical waveguide is formed face the element mount surface of the silicon bench (10), in order to easily align the optical axis.

The Office Action equates the substrate (120; 370) of the Deacon device to the claimed silicon bench. It is submitted that this interpretation is incorrect, at least because the substrate and the waveguides in the Deacon device are integrally formed. Deacon teaches, as shown in Figs. 1 and 3, a configuration such that a stepped portion is provided at a part of the substrate (120; 370) in which optical waveguides are formed, with the LD elements arranged on this stepped portion. The Deacon device comprises, as a main component, an optical waveguide and LD elements. Additionally, in the Deacon device, the optical waveguides each have a grating integrally formed on the substrate. Thus the Deacon device does not assume a separation between the optical waveguides and the substrate, and cannot actually separate the waveguides

from the substrate. Furthermore, Fig. 3 shows the LD elements as being fixed with epi-down (configuration such that the epi-layers including the active layer are formed on the substrate).

In contrast with the claimed invention, wherein the optical circuit element (30) is changeable at the silicon bench (10), in the Deacon structure the LD elements are fixed on the substrate in which the waveguides are formed. Deacon does not disclose the claimed silicon bench on which the semiconductor optical amplifier (20) and the optical circuit element (30) have an optical waveguide mounted through the bonding materials.

In addition, Deacon does not teach or suggest the claimed structure wherein the semiconductor optical amplifier (20) and the optical circuit element (30) are arranged on the silicon bench (10) such that the surface on which an active layer is formed and the surface on which an optical waveguide is formed face the element mount surface of the silicon bench (10). In the Deacon device, the height direction alignment (y-direction alignment) between optical axes of the active layers in the LD elements and the optical waveguides is performed after a misalignment in a height direction is preliminarily measured. That is, the misalignment value in the height direction is adjusted by precisely controlling each layer thickness of a laminate structure that comprises metal layers and solder such as adhesion layer (352; 358), barrier layer (354; 360), cap layer (356; 362) and solder layer (350).

In contrast, in the claimed invention the semiconductor optical amplifier (20) and optical circuit element (30) are arranged on the silicon bench (10) such that the surface on which an active layer is formed and the surface on which an optical waveguide is formed face the element mount surface of the silicon bench (10). Since the position of the active layer from the surface of the semiconductor optical amplifier (thickness of the semiconductor optical amplifier) and the position of the optical waveguide from the surface the optical circuit element are preliminarily

known, a thickness of each optical component can be designed such that the axes of the active layer and the waveguide are matched to each other. Therefore, the axes of these optical components can be appropriately matched by merely mounting these components on the silicon bench. In addition, the claimed invention permits selection of an optical circuit element in which the optical waveguide with a different grating pitch is formed to meet a particular intended purpose or application; the mounted optical circuit element can be easily changed to the desirable optical circuit element, or the desirable optical circuit element can be mounted while combining it with the semiconductor optical amplifier. It is clear that the Deacon device cannot change the optical waveguide component after the LD elements are mounted on the substrate.

It is submitted, therefore, that claims 1, 3, 14 through 16, 18 and 29 are patentably distinguishable.

Claims 4, 5, 19 and 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Deacon in view of U.S. patent 6,435,734 (Okada). The Okada disclosure has been relied upon solely for addressing the additional requirements of these dependent claims. To the extent that the rejection may be considered with respect to the claims as now amended, the rejection is respectfully traversed. There is nothing in the Okada disclosure, when considered with that of Deacon that would have led a person of ordinary skill in the art to the invention recited in parent claims 1 and 15, discussed above.

Claims 6 and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Deacon in view of U.S. published application 2002/0031297 (Forrest). The Forrest disclosure has been relied upon solely for addressing the additional requirements of these dependent claims. To the extent that the rejection may be considered with respect to the claims as now amended, the rejection is respectfully traversed. There is nothing in the Forrest disclosure, when

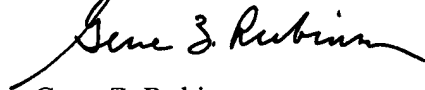
considered with that of Deacon that would have led a person of ordinary skill in the art to the invention recited in parent claims 1 and 15, discussed above.

Claims 8 and 23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Deacon in view of U.S. patent 6,411,764 (Lee). The Lee disclosure has been relied upon solely for addressing the additional requirements of these dependent claims. To the extent that the rejection may be considered with respect to the claims as now amended, the rejection is respectfully traversed. There is nothing in the Lee disclosure, when considered with that of Deacon that would have led a person of ordinary skill in the art to the invention recited in parent claims 1 and 15, discussed above.

Accordingly, it is submitted that claims 1, 3 through 6, 8, 14 through 16, 18 through 21, 23 and 29 are patentably distinguishable. Allowance of the application is respectfully solicited. To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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